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Feasibility Impact Analysis Report
Surface Vessel Bilgewater/Oil Water Separator

Section 11.0 – UTB 41 Class: Vessels with Compression Ignition Engines and Less than 65 Feet in Length, Small Boats, and Service Vessels

2003

SECTION 11.0 – UTB 41 CLASS

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11.0 UTB 41 CLASS

The U.S. Coast Guard's UTB 41 Class of utility boats was selected to represent the group of diesel-powered boats under 65 feet in length. These 41-foot utility boats operate primarily within 12 nautical miles (nm) of shore, but may occasionally be required to operate beyond 12 nm. The amount of time these vessels spend beyond 12 nm annually is considered negligible. Therefore, it is assumed that the bilgewater generated annually by these boats is produced within 12 nm. The UTB 41s operate on a daily basis approximately 358 days each year, where they spend a portion of each day both in port and underway. When underway, these boats generally operate for short periods of time (i.e., 2 hours) and spend the remainder of the day in port (Volpe, 2000c). It is estimated that the boats spend approximately seven days per year out of the water for maintenance. Assuming two hours of underway operations and the balance of each day in port, UTB 41 Class vessels generate approximately 2.5 gallons of bilgewater per day (i.e., 0.5 gpd in port and 2 gpd underway) (Volpe, 2000b). Each vessel in this class generates approximately 900 gallons of bilgewater within 12 nm annually.

Bilgewater generated within 12 nm from shore:

$$\frac{358\text{ days (in water)}}{\text{yr}} \bullet \frac{2.5\text{ gal}}{\text{day}} = 900\text{ gal/yr}$$

There is no oil-water separating system installed on-board UTB 41 Class vessels. Although these boats are equipped with two 29-gpm bilge pumps, the crew uses sponges and buckets to collect and transfer to shore the small volume of bilgewater generated. The bilge pumps are primarily used in emergencies when the craft has taken on a significant amount of water. The following marine pollution control devices (MPCDs) are evaluated in this feasibility analysis for UTB 41 Class vessels: collection, holding and transfer (CHT); centrifuge; evaporation; gravity coalescence; hydrocyclone; *in situ* biological treatment; oil absorbing socks (OASs); filter media; and membrane filtration.

11.1 COLLECTION, HOLDING AND TRANSFER (CHT)

The following sections discuss the feasibility and cost impacts of practicing CHT on-board a UTB 41 Class vessel.

11.1.1 Practicability and Operational Impact Analysis

This section analyzes specific feasibility criteria relative to the physical characteristics and operational requirements of CHT.

11.1.1.1 Space and Weight

Due to their small size and low bilgewater generation rate, UTB 41 Class vessels are not equipped with an oil water separator (OWS) or oily waste holding tank (OWHT). Instead, these vessels practice CHT, where any wastewater that is generated accumulates in the open bilge spaces and is transferred to shore, as described above, when these vessels return to port.

UTB 41 Class vessels operate frequently, going on patrol everyday. While the average patrol only lasts two hours, these boats are able to operate for 6 to 8 hours at a time when necessary. These boats generate approximately 2 gallons of bilgewater per day while underway (i.e., one gallon/hr) and approximately 0.5 gallons per day while pierside, for a daily total of 2.5 gallons. The bilges of these boats are inspected and cleared of any fuel, oil, or water before and after every mission (U.S. Coast Guard, 1997). Therefore, the maximum amount of bilgewater likely to accumulate is approximately 2.5 gallons. This volume of wastewater in the bilge would not result in any measurable impacts to space and weight, or pose a hazard to the operation of the vessel. Any bilgewater that has collected in the bilge during a mission would be cleaned up by the crew using buckets and sponges and transferred to shore for disposal.

11.1.1.2 Personnel/Equipment Safety

Practicing CHT does not pose any safety hazards to the vessel's crew or equipment. Other than following standard procedures for handling oily waste, no special precautions are necessary.

11.1.1.3 Mission Capabilities

Practicing CHT on UTB 41 Class vessels has not had an impact on ship's mobility, or on any mission critical systems or operations.

11.1.1.4 Personnel Impact

Practicing CHT as a primary control option does not require special training. No more than two crewmembers are needed to offload any wastewater that accumulated in the bilge spaces. Although UTB 41 Class vessels are equipped with bilge pumps, buckets and sponges are used to transfer the bilgewater when in port. The bilge pumps are for emergency dewatering purposes only and do not have shore connections necessary for transferring bilgewater to shore facilities. Also, the use of buckets and sponges is necessary to clean the bilge sufficiently to allow the vessel operators to detect fuel leaks.

Each UTB 41 Class vessel generates approximately 900 gallons of bilgewater within 12 nm annually, as calculated below.

$$358\,\text{days}\,(\text{pierside and within}\,12\,\text{nm}) \bullet \frac{2.5\,\text{gal}}{\text{day}} = 900\,\text{gal}$$

UTB 41 Class boats operate beyond 12 nm of shore for only a small portion of each year. Therefore, the amount of bilgewater generated while operating beyond 12 nm is considered negligible. The small amount of bilgewater that is generated while the boats are operating beyond 12 nm is included in the volume calculated for operations within 12 nm of shore.

Assuming it takes one crewmember approximately 30 minutes, or two crewmembers 15 minutes each, to transfer the average amount (2.5 gallons) of bilgewater generated daily using a bucket and sponge, a total of 180hours per year are required to offload the bilgewater, as calculated below.

$$\frac{0.5\,\text{hrs labor}}{\text{day}} \bullet \frac{358\,\text{days}}{\text{year}} = 180\ \text{hrs/yr}$$

No maintenance is required to perform CHT. Table 11-1 provides the annual labor hours required to perform CHT.

Table 11-1. CHT Annual Labor Hours (UTB 41 Class)

	CHT
Operator Hours Within 12 nm	180
Operator Hours Beyond 12 nm	-
Condition-based Maintenance Within 12 nm	0
Condition-based Maintenance Beyond 12 nm	-
Time-based Maintenance	0
Total Time	180

11.1.1.5 Consumables, Repair Parts, and Tools

There are no requirements for significant consumables, repair parts, or tools associated with CHT.

11.1.1.6 Interface Requirements

Practicing CHT does not require any unique interface requirements. As previously explained, bilgewater that accumulates in these vessels is typically transferred to shore using sponges and buckets.

11.1.1.7 Control System Requirements

There are no automated control system requirements associated with CHT.

11.1.1.8 Other/Unique Characteristics

No other/unique characteristics have been identified with respect to this MPCD option.

11.1.2 Cost Analysis

The following cost data and calculations are provided to allow the reader to compare relative costs associated with a CHT system on a UTB 41 Class vessel.

11.1.2.1 Initial Cost

Continuing to practice CHT within 12 nm on UTB 41 Class vessels does not require any equipment or boat modifications. Therefore, the initial cost of practicing CHT is assumed to be zero.

11.1.2.2 Recurring Cost

The MPCD requires 180 personnel hours per year for transfer of waste oil to shore, as explained under Section 11.1.1.4. The annual labor hours multiplied by the $22.64 per hour MPCD operator labor rate produces the annual recurring labor cost of approximately $4,100.

$$\frac{\$22.64}{\text{hr}} \bullet \frac{180\,\text{hrs}}{\text{yr}} = \$4{,}100\,/\,\text{yr}$$

The volume of bilgewater generated annually within 12 nm is 900 gallons per year. Multiplying this volume by the oily waste disposal unit cost produces an annual recurring disposal cost of $67, as calculated below.

$$\frac{900\,\text{gal}}{\text{yr}} \bullet \frac{\$0.0749}{\text{gal}} = \$67/\text{yr}$$

The bilgewater generated annually within 12 nm multiplied by the oily waste disposal unit cost for Coast Guard vessels produces the annual recurring disposal cost for CHT on a UTB 41 Class vessel of $810.

$$\frac{900\ \text{gal}}{\text{yr}} \bullet \frac{\$0.91}{\text{gal}} = \$810/\text{yr}$$

Table 11-2 provides the annual recurring costs of using CHT on a UTB 41 Class vessel.

Table 11-2. Annual Recurring Costs for CHT (UTB 41 Class)

Vessel Operating Parameter	Disposal Cost Used	Annual Recurring Cost ($K)
Within 12nm	Navy	4.1
Beyond 12nm	Navy	-
Within 12nm	Coast Guard	4.9
Beyond 12nm	Coast Guard	-

11.1.2.3 Total Ownership Cost (TOC)

Table 11-3 summarizes the TOC and annualized cost over a 15-year lifecycle of practicing CHT on the UTB 41.

Table 11-3. TOC for CHT (UTB 41 Class)

Cost ($K)	Vessel Operation Within 12 nm	Vessel Operation Within + Beyond 12 nm	USCG Vessel Operation Within 12 nm	USCG Vessel Operation Within + Beyond 12 nm
Total Initial	0	0	0	0
Total Recurring	49	49	58	58
TOC (15-yr lifecycle)	49	49	58	58
Annualized	4.2	4.2	4.9	4.9

11.2 CENTRIFUGE

Based on a ship check of a UTB 41 Class vessel and information provided by service craft personnel, these vessels cannot provide the electrical power and potable water required to operate a centrifuge system (Navy, 2000). In addition, adequate space is not available on UTB 41 Class vessels to accommodate the installation of a centrifuge system (Navy, 2000). Therefore, no further analysis will be conducted with regard to the use of centrifuges on UTB 41 Class vessels.

11.3 EVAPORATION

Based on a ship check of a UTB 41 Class vessel and information provided by service craft personnel, these vessels cannot provide the electrical power required to operate an evaporation system (Navy, 2000). In addition, adequate space is not available on UTB 41 vessels to accommodate the installation of an evaporation system (Navy, 2000). Therefore, no further analysis will be conducted with regard to the use of evaporation on UTB 41 Class vessels.

11.4 GRAVITY COALESCENCE

Based on a ship check of a UTB 41 Class vessel and information provided by service craft personnel, these vessels cannot provide the electrical power required to operate a gravity coalescer (Navy, 2000). In addition, adequate space is not available on UTB 41 Class vessels to accommodate the installation of a gravity coalescence system (Navy, 2000). Therefore, no further analysis will be conducted with regard to the use of gravity coalescence on UTB 41 Class vessels.

11.5 HYDROCYCLONES

Based on a ship check of a UTB 41 Class vessel and information provided by service craft personnel, these vessels cannot provide the electrical power required to operate a hydrocyclone system (Navy, 2000). In addition, adequate space is not available on UTB 41 Class vessels to accommodate the installation of a centrifuge system (Navy, 2000). Therefore, no further analysis will be conducted with regard to the use of hydrocyclones on UTB 41 Class vessels.

11.6 *IN SITU* BIOLOGICAL TREATMENT

The following sections discuss the feasibility and cost impacts of using *in situ* biological treatment on-board a UTB 41 Class vessel.

11.6.1 Practicability and Operational Impact Analysis

This section analyzes specific feasibility criteria relative to the physical characteristics and operational requirements of *in situ* biological treatment on a UTB 41 Class vessel.

11.6.1.1 Space and Weight

Due to their small size and low bilgewater generation rate, UTB 41 Class vessels are not equipped with any type of OWS or OWHT. These vessels practice CHT, where any wastewater that is generated accumulates in one of two small open bilge spaces and is transferred to shore when the vessels return to port. UTB 41 Class vessels operate frequently, typically once every day, but only operate for short periods of time (i.e., two hours/mission). UTB 41 Class vessels generally operate within 12 nm. On an average day, UTB 41 Class vessels generate 2.5 gallons of bilgewater. Approximately 0.025 gal/day (1 percent) of the bilgewater generated during a typical operation is waste oil.

According to the vendor, the most effective use of *in situ* biological treatment for the wastewater that accumulates in the bilge is to leave 0.5 pounds of *in situ* material in each of the two bilge areas on the UTB 41 Class vessel (a total of one pound), for a 30-day period to establish a population of microbes (Opsanick, 2000). Transferring bilgewater to shore or allowing additional bilgewater to be introduced to the bilge area before the 30-day period is complete may decrease the *in situ* biological treatment's effectiveness. Due to the lack of performance data, the extent *in situ* biological treatment's effectiveness would be decreased can not be determined (Opsanick, 2000). However, the craft would be continuously generating bilgewater during this period, disrupting the batch processing method recommended by the manufacturer. Furthermore, the craft's total bilgewater generation over a 30-day period is 80 gallons. Holding this volume of bilgewater to allow more complete treatment would have a significant space and weight impact. Therefore, to minimize this impact, the bilgewater may not remain in the bilge areas for the recommended 30-day remediation period (see Section 11.6.1.3).

11.6.1.2 Personnel/Equipment Safety

In situ biological treatment has not been shown to be a danger to personnel. *In situ* biological treatment has been used on pleasure boats without any reports of adverse affects to human health. Following standard procedures for handling hazardous material (e.g., oil and grease) is sufficient for ensuring personnel and equipment safety. Other than wearing standard personal protective equipment (e.g., rubber gloves/boots and safety glasses/goggles) during collection activities, no special devices or precautions are necessary.

11.6.1.3 Mission Capabilities

The most effective use of *in situ* biological treatment requires the bilgewater to be held for a 30-day period. However, the volume of bilgewater, generated over 30 days, will exceed the craft's bilgewater holding capacity and the resulting weight of holding the bilgewater will decrease the UTB 41 Class vessel's speed, reserve buoyancy, and stability. Therefore, to minimize impact on the craft's mission, the accumulated bilgewater and *in situ* biological treatment may not remain in the bilge area for the period of time required to meet its maximum potential effectiveness.

11.6.1.4 Personnel Impact

The crew would place the *in situ* material in the bilge and replace it after it has completely biodegraded. The *in situ* material could take as long as one to three months to degrade. Specific replacement intervals cannot be determined at this time because it is unlikely that the Armed Forces would allow the bilgewater to accumulate for the suggested 30-day period. However, using biological treatment does not require special training, and the time demand it places on the vessel's crew is expected to be negligible.

11.6.1.5 Consumables, Repair Parts, and Tools

The rate that the *in situ* material is replaced is dependent on a number of factors. These factors include bilgewater temperature, bilgewater oil content, and availability of nutrients. The vendor is not able to provide the actual period of time it may take for the one pound of *in situ* material to biodegrade, but suggests it may vary from one to three months. The *in situ* material can be stored shore side until it is needed. There are no requirements for repair parts or tools associated with *in situ* biological treatment.

11.6.1.6 Interface Requirements

The use of *in situ* biological treatment does not require any unique interface requirements. The use of *in situ* biological treatment would not prevent shore side waste disposal facilities from accepting the waste oil for disposal (Binkley, 2000).

11.6.1.7 Control System Requirements

There are no automated control system requirements associated with this MPCD.

11.6.1.8 Other/Unique Characteristics

The long-term effect that *in situ* biological treatments may have on aluminum hulls has not been determined. Although *in situ* biological treatments are routinely used in small pleasure craft with aluminum hulls, no controlled testing has been performed by the vendor to ensure that the microbes used in *in situ* biological treatment will not have an adverse effect on aluminum hulls. Furthermore, the boat's cotton impregnated synthetic rubber gaskets may also be damaged by *in situ* material. The vendor cannot verify that the microbes used in *in situ* biological treatment will not damage cotton impregnated synthetic rubber gaskets. Because these potential concerns have not been fully researched, USCG Headquarters has not sponsored or approved the use of this product at this time.

The microbe population will continuously digest oil that seeps into the bilge. However, due to variations in residence time and the potential for bilgewater to continuously accumulate, the *in situ* material should not be expected to digest the oil content of the bilgewater such that it can be discharged. When used in conjunction with CHT, *in situ* material will decrease the oil content in the bilgewater keeping the bilge area cleaner.

11.6.2 Cost Analysis

The following cost data and calculations are provided to allow the reader to compare relative costs associated with an *in situ* biological treatment system on a UTB 41 Class vessel.

11.6.2.1 Initial Cost

The cost of the *in situ* material is more appropriately addressed under the recurring cost section. Additional tankage, piping systems, etc. are not required for this potential MPCD. Technical manuals cost approximately $30,000 ($150 per vessel) to develop. Therefore, the total first operating year initial cost of *in situ* biological treatment on a UTB 41 is $150.

11.6.2.2 Recurring Cost

The recurring cost of *in situ* biological treatment is equal to the consumable cost of the *in situ* material. The use of *in situ* biological treatment only requires the operator to place *in situ* material in the bilge. Therefore the personnel hours required for operation and the associated labor cost is negligible. Because the rate that *in situ* material biodegrades varies depending on the conditions in the bilge and replacement rates are dictated by a vessel's mission, the cost of replacing the *in situ* material will vary. Assuming that one pound of *in situ* material is added to the bilge on a monthly basis and given that the cost of the *in situ* material is $60.00 per pound, a recurring cost estimate is found by the following:

$$\frac{1\,\text{lb}}{\text{month}} \bullet \frac{12\,\text{months}}{\text{yr}} \bullet \frac{\$60.00}{\text{lb}} = \$700/\text{year}$$

The total annual recurring cost for *in situ* biological treatment aboard a UTB 41 Class vessel could be as low as $700. However, because bilgewater may be transferred to shore more frequently than once each month to minimize space, weight, and mission impacts, the recurring cost of this potential MPCD could increase significantly.

Table 11-4 summarizes the annual recurring costs of using *in situ* biological treatment on a UTB 41 Class vessel.

Table 11-4. Annual Recurring Costs for *In situ* Biological Treatment (UTB 41 Class)

Vessel Operating Parameter	Disposal Cost Used	Annual Recurring Cost ($K)
Within 12nm	Navy	0.7
Beyond 12nm	Navy	-
Within 12nm	Coast Guard	0.7
Beyond 12nm	Coast Guard	-

11.6.2.3 Total Ownership Cost (TOC)

Table 11-5 summarizes the TOC and annualized cost over a 15-year lifecycle of using *in situ* biological treatment on the UTB 41 Class vessel.

Table 11-5. TOC for *In situ* Biological Treatment (UTB 41 Class)

Cost ($K)	Vessel Operation Within 12 nm	Vessel Operation Within + Beyond 12 nm	USCG Vessel Operation Within 12 nm	USCG Vessel Operation Within + Beyond 12 nm
Total Initial	.15	.15	.15	.15
Total Recurring	8.6	8.6	8.6	8.6
TOC (15-yr lifecycle)	8.75	8.75	8.75	8.75
Annualized	.7	.7	.7	.7

11.7 OIL ABSORBING SOCKS (OASS)

OASs are designed to absorb oil found floating on the surface of a body of water (Sorbent Products, Inc., 2000). In this application, OASs would be placed inside the bilge areas of a UTB 41 Class vessel to continuously absorb the waste oil from the bilgewater. When the OASs become fully saturated, they are manually removed and replaced with new OASs. This use of OASs for UTB 41 Class vessels poses concerns regarding the potential to affect emergency dewatering and to become a fuel source for a fire.

The presence of OASs in the bilge spaces could potentially restrict or prevent the flow of bilgewater through the normal and emergency dewatering pumps and strainers by clogging the suction points. The Navy and Coast Guard prohibit the presence of any loose materials or debris in the bilge areas for this reason. Furthermore, as the OAS absorbs oil it becomes a concentrated fuel source for a fire.

Based on the potential operational and safety impacts related to emergency dewatering and potential fire hazards, OASs are not a feasible MPCD option group for the UTB 41 Class vessel group.

11.8 FILTER MEDIA

The following sections discuss the feasibility and cost impacts of installing and operating an in-line filter on-board UTB 41 Class vessels.

11.8.1 Practicability and Operational Impact Analysis

This section analyzes specific feasibility criteria relative to the physical characteristics and operational requirements of the in-line filter unit.

11.8.1.1 Space and Weight

The in-line filter selected for the analysis is manufactured specifically for boats and is representative in size and capacity of the in-line filters on the market.

According to the vendor, some commercial vessels have had limited success installing in-line filter units between their bilge pump and the overboard hull fitting. Table 11-6 summarizes the space and weight for an in-line filter system.

Table 11-6. In-line Filter Specifications (UTB 41 Class)

Physical Properties	Number of Units	Capacity	Size (ft.) L x W x H	Maintenance Envelope (ft.)	Volume (ft^3)	Weight (lbs.) Dry/Flooded
Per unit	1	50-2000 gph	12.5 x 5.25	Approx. 24 x 10	271	3.5/6.5
Total (To achieve required processing capacity)	1	50-2000 gph	-	-	271	3.5/6.5

11.8.1.2 Personnel/Equipment Safety

There are no unusual personnel or equipment safety hazards associated with in-line filter systems. Other than wearing standard personal equipment (e.g., rubber gloves/boots and safety glasses/goggles) during maintenance activities, no special devices or precautions are necessary. Any hazardous materials (e.g., oil and grease) required for operation and maintenance are minimal in quantity and authorized for use. Standard afloat control and management procedures are adequate for use and disposal of the material.

11.8.1.3 Mission Capabilities

Relying exclusively upon the bilge pump and the in-line filter to remove bilgewater will have a negative impact on the vessel's mission. The bilge pumps are unable to pump the bilge completely dry and the remaining bilgewater may prevent the identification of fuel leaks. Early identification of small fuel leaks is essential to preventing major fuel leaks that could potentially interfere with vessel operation.

11.8.1.4 Personnel Impact

The in-line filter unit runs in automatic mode, but requires general supervision while the unit is operating. Every two hours, 0.25 hours (15 minutes) of general oversight is assumed. Based on a bilgewater processing rate of 50 gallons per hour (gph), and the annual bilgewater generation within 12 nm of shore of 900 gal, the annual labor requirement associated with in-line filter oversight is 2.2 hours.

$$\frac{900\,\text{gal}}{\text{yr}} \bullet \frac{\text{hr}}{50\,\text{gal}} \bullet \frac{0.25\,\text{hrs labor}}{2\,\text{hours}} = 2.2\,\text{hrs labor/yr}$$

The recovered waste oil is absorbed into filter canisters that must be offloaded as solid waste or taken to an oil recycle station. The time required to replace a filter canister is estimated at 1 hour. Each in-line filter unit comes equipped with a single filter cartridge, thus the total replacement time is one hour. With a total processing rate of 50 gph and a total of 900 gallons of effluent to be processed annually, the filter media will have to operate 18 hours per year. Based upon the low bilge generation rate, the expected bilgewater mix, and a low operational time period, labor hours associated with filter canister replacement are expected to be negligible.

Once used, the filter cartridge element can be disposed of at a local oil recycling station. However, labor hours directly associated with element disposal are not expected to be significant.

Annually, the in-line filter requires 0 personnel hours of time-based maintenance, 0 personnel hours of condition-based maintenance within 12 nm, and 0 personnel hours of condition-based maintenance beyond 12 nm. Table 11-7 and Table 11-8 summarize the time-based and condition-based maintenance requirements, respectively, for one 50-gph in-line filter unit.

Table 11-7. Filter Media Time-Based Maintenance (UTB 41 Class)

Maintenance Activity	Maintenance Time (hours)	Frequency	Annualized Maintenance Time (hours)
None	0	0	0
Total Annual Labor per unit	-	-	0
Total Annual Labor per vessel	-	-	0

Table 11-8. Filter Media Condition-Based Maintenance (UTB 41 Class)

Maintenance Activity	Maintenance Time (hours)	Frequency (based on hours of MPCD operation)	Annualized Maintenance Hours (based on 2 operation hours within 12 nm)	Annualized Maintenance Hours (based on operation hours beyond 12 nm)
Replace Filter Media Canisters	-	-	-	-
Total Annualized Hours	-	-	-	-

Table 11-9 provides the annual labor hours required to operate and maintain the proposed MPCD discussed in this section.

Table 11-9. Filter Media Annual Labor Hours (UTB 41 Class)

	MPCD Option: In-line Filter
Operator Hours Within 12 nm	2.2
Operator Hours Beyond 12 nm	0
Condition-based Maintenance Within 12 nm	0
Condition-based Maintenance Beyond 12 nm	0
Time-based Maintenance	0
Total Time	2.2

11.8.1.5 Consumables, Repair Parts, and Tools

The in-line filter unit requires filter canister replacement. Spare canisters may be stored on the vessel or shoreside. No special repair parts or tools are required for the operation or maintenance of this unit.

11.8.1.6 Interface Requirements

No specific system interface requirements are associated with the in-line filter unit.

11.8.1.7 Control System Requirements

The in-line filter unit does not have any unique control system requirements.

11.8.1.8 Other/Unique Characteristics

In-line filter technology has been used on many small commercial vessels and has been tested and used on relatively low contaminant bilgewater. Therefore, more verification and testing is necessary before installation on Armed Forces vessels to process bilgewater which is likely to be much more variable in content with potentially higher constituent loadings. Additionally, the in-line filter system is not designed or intended to “clean the bilge.” It is designed to remove hydrocarbons that are part of common bilgewater. Best results are obtained by keeping your bilge clean and machinery tight. Bilge areas that are full of sediment may require a pre-filter to screen sediments that might otherwise foul and clog the oil-absorbing canister.

Additionally, this MPCD may not be capable of treating bilgewater such that it can be discharged into surface waters in accordance with current parts per million oil concentration limits. Without a fail-safe discharge oil content monitor, the potential exists to discharge a visible sheen due to a failure of the in-line filter system. The resulting pollution response would divert the vessel and its crew from their primary mission.

11.8.2 Cost Analysis

The following cost data and calculations are provided to allow the reader to compare relative costs associated with using a filter media system to treat bilgewater on a UTB 41 Class vessel.

11.8.2.1 Initial Cost

The filter media system procurement cost is $120 and the related hardware is $350, which is a total initial cost of $480 per vessel (Liberty Bay Solutions, 2001). Based on the Navy's NSWCCD, the installation of a filter media will cost $300,000 ($1,500 per vessel). Technical manuals, drawings and integrated logistic costs will be $15,000 ($80 per vessel) (Navy, 2000). The total initial cost of a filter media system on a UTB 41 is $2,060 per vessel.

11.8.2.2 Recurring Costs

This MPCD requires 2.2 personnel hours per year for operation within 12 nm, as explained under Section 11.8.1.4. The number or annual labor hours multiplied by $22.64 hourly MPCD operator labor rate produces the annual labor cost within 12nm.

$$\frac{\$22.64}{\text{hr}} \bullet \frac{2.2 \text{ hrs}}{\text{yr}} = \$51/\text{yr}$$

The cost of a new filter unit and replacing that unit is negligible.

Table 11-10 summarizes the annual recurring costs of using filter media on a UTB 41 Class vessel.

Table 11-10. Annual Recurring Costs for a Filter Media System (UTB 41 Class)

Vessel Operating Parameter	Disposal Cost Used	Annual Recurring Cost ($K)
Within 12nm	Navy	0.051
Beyond 12nm	Navy	-
Within 12nm	Coast Guard	0.051
Beyond 12nm	Coast Guard	-

11.8.2.3 Total Ownership Cost (TOC)

Table 11-11 summarizes the TOC and annualized cost over a 15-year lifecycle of using a filter media system on the UTB 41.

Table 11-11. TOC for Filter Media (UTB 41 Class)

Cost ($K)	Vessel Operation Within 12 nm	Vessel Operation Within + Beyond 12 nm	USCG Vessel Operation Within 12 nm	USCG Vessel Operation Within + Beyond 12 nm
Total Initial	2.06	2.06	2.06	2.06
Total Recurring	.6	.6	.6	.6
TOC (15-yr lifecycle)	2.66	2.66	2.66	2.66
Annualized	0.22	0.22	0.22	0.22

11.9 MEMBRANE FILTRATION

Based on a ship check of a UTB 41 Class vessel and information provided by service craft personnel, the Navy's Alteration and Installation Team (AIT) has concluded that adequate space is not available on UTB 41 Class vessels to accommodate a membrane filtration system (Navy, 2000). Furthermore, installation of a secondary treatment, such as membrane filtration, requires the installation of a primary OWS. Because UTB 41 Class vessels cannot accommodate a primary OWS, membrane filtration is not able to operate properly on this vessel class. Therefore, no further analysis will be conducted with regard to the use of membrane filtration on UTB 41 Class vessels.